GPS Auto-Registration System

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Objectives of Auto-Registration

- Improve the effectiveness of artillery rounds in current inventory
  - Increased firepower and survivability
  - Reduced logistics burden
- Force structure compatibility
  - Fuze module form factor per NATO standard
  - No change to inductive fuze setter
  - Minimum impact on platforms
    - Fully automated and passive
- Low cost

- Supports the Army XXI thrust to:

  "Take the equipment in inventory today...and enhance them with information age technology."

  General Dennis J. Reimer, Chief of Staff, Army

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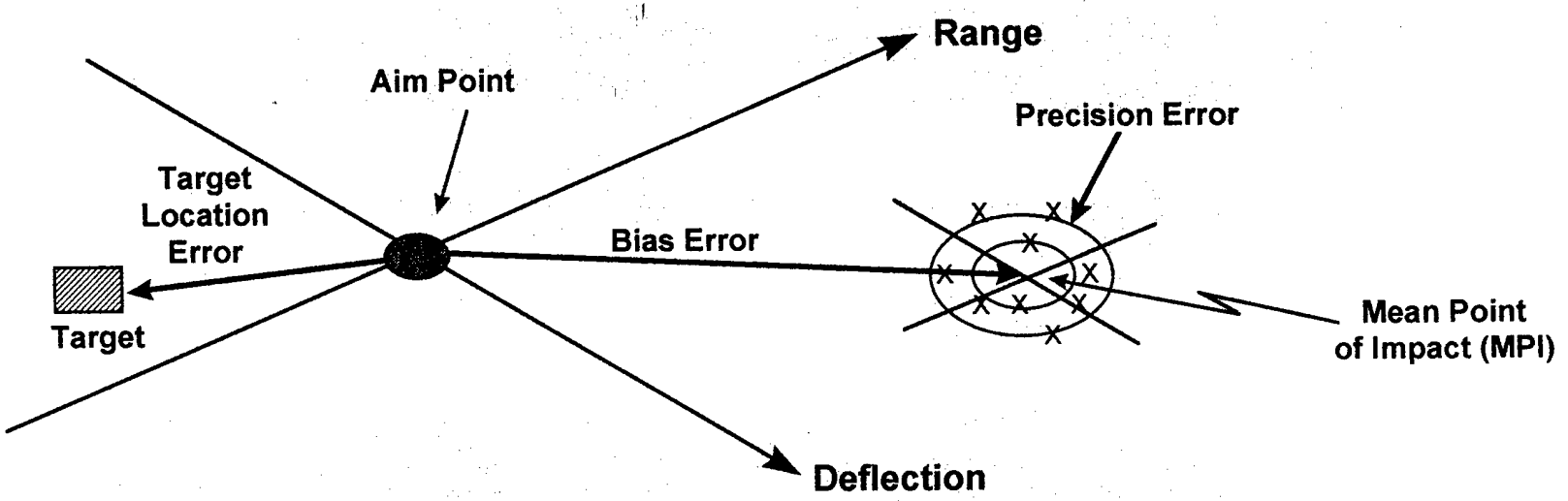
Problem — Bias Errors at Extended Ranges



- Bias Error (MPI Error) - Variation of the mean impact from the Aim Point
- Precision Error - Variation of round impacts about the mean
- Target Location Error - Variation of the Aim Point to the Target

Current Procedures

- Forward observers for estimating miss distances and communicating information back to shooter
  - Increasingly hazardous for deeper attacks
- Patterned fires to assure coverage
  - Consumes large number of rounds per mission

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GPS Auto-Registration Approach

Translator Implementation

- Captures and re-transmits GPS signals to a Ground Based Receiver
  - Translator electronics located in fuze module
- GPS receivers located at Ground Based Receiver process GPS signals to estimate projectile positions
  - Advances in GPS receivers do not impact fuze inventory

Advantages of GPS System

- Provides position data accuracy which is range independent
- Provides all-weather capability
- Leverages Army and Navy development activities on small, low cost GPS technology for projectiles

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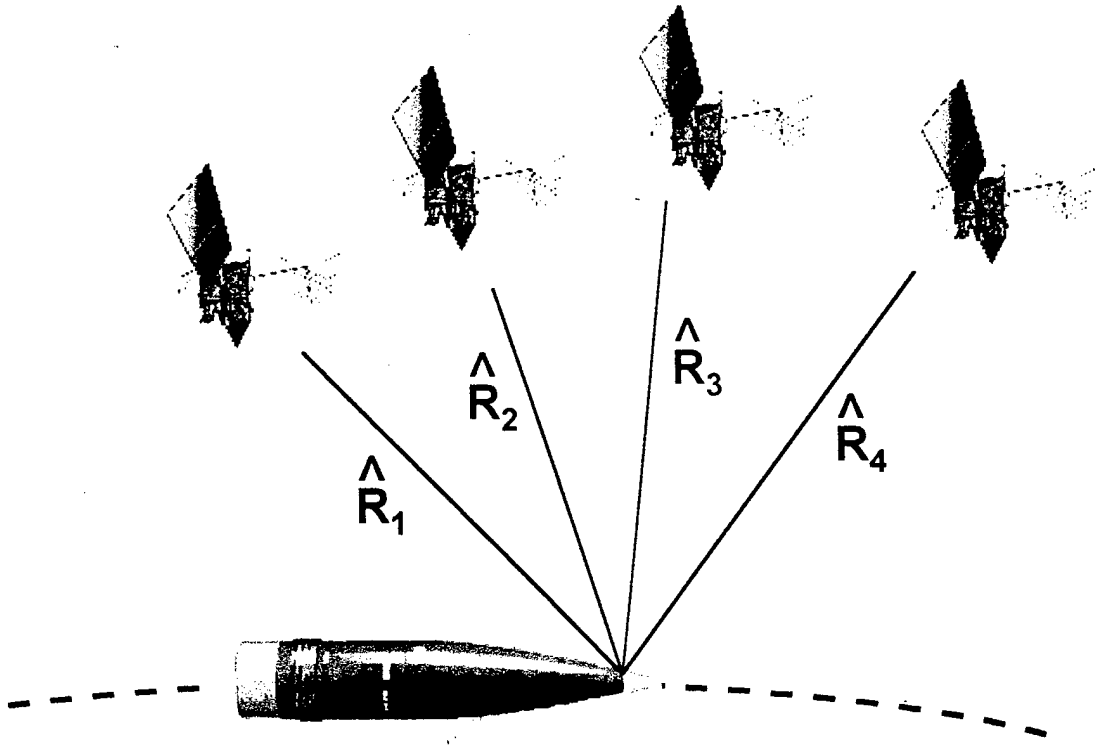
GPS Position Estimation



- **Based on simultaneous measurement to four satellite positions**
- **Provides position of the capturing antenna on the projectile**

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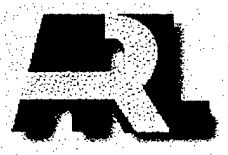
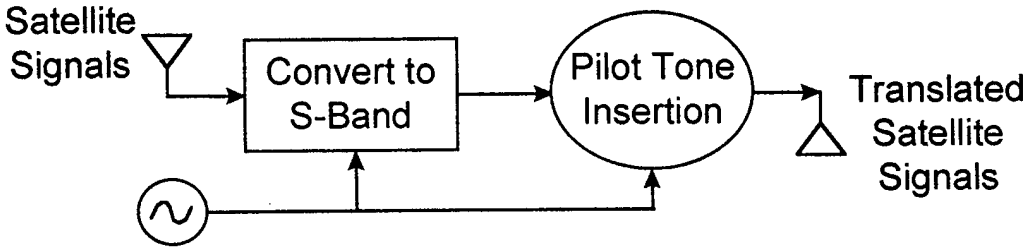


Translator System Block Diagram

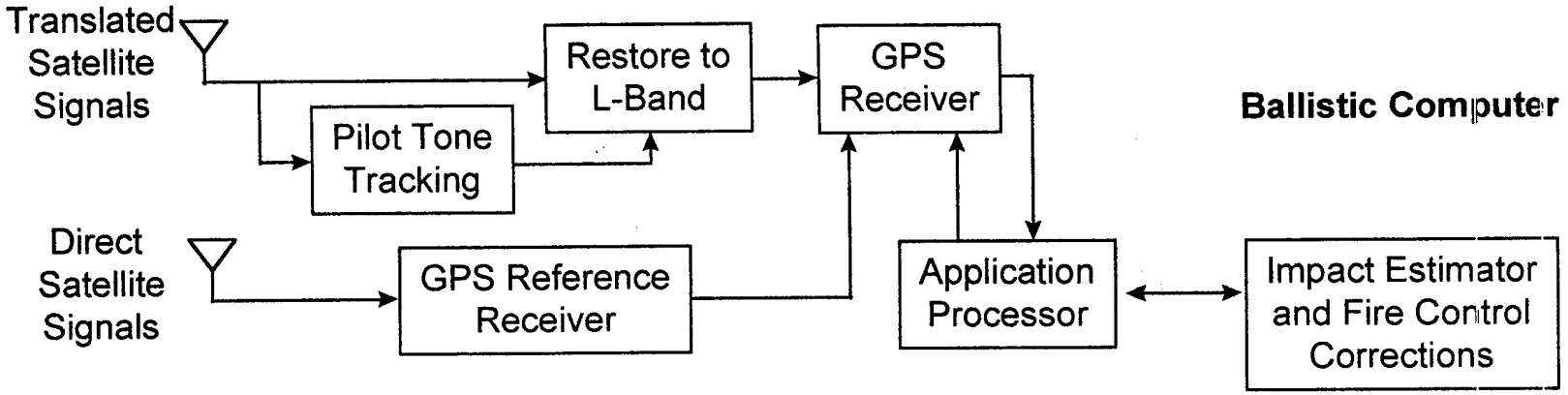
GPS Auto-Registration Fuze Module



Located on Projectile

Located on Ground

Ground Based Receiver



Ballistic Computer

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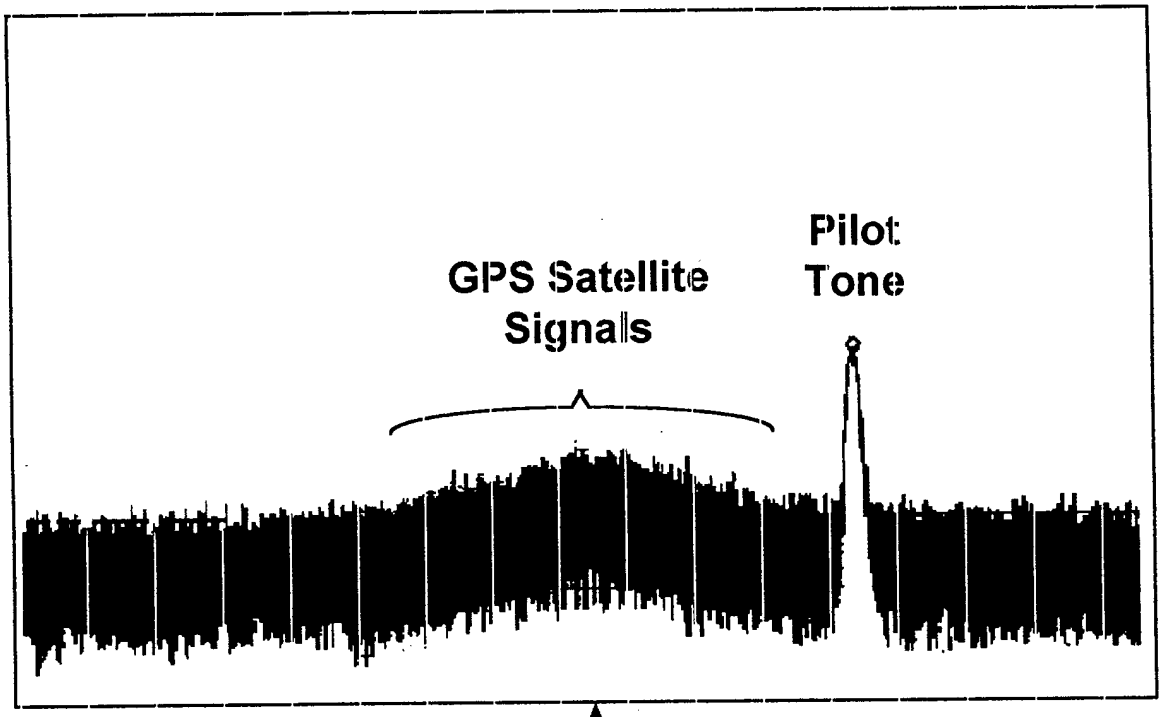
Translated GPS Signal



2.266 GHz
Translated from Original 1.575 GHz

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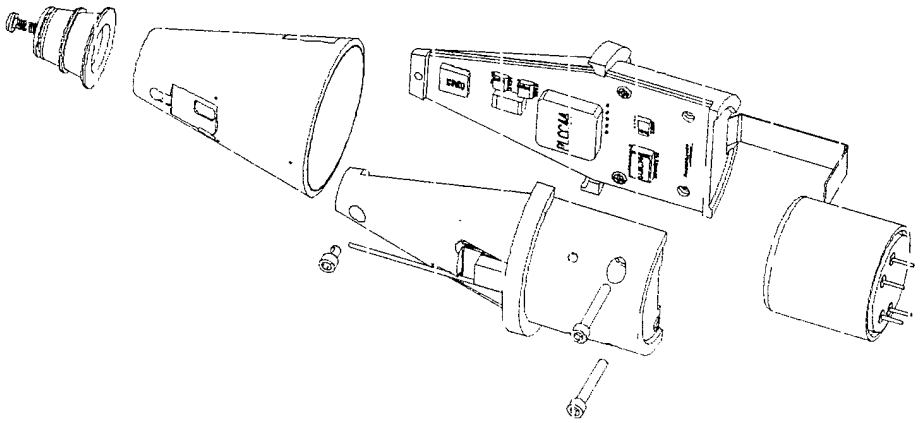
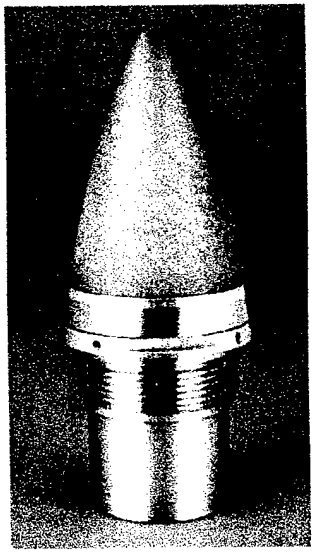
GPS Auto-Registration Fuze

- L-Band to S-Band Frequency Translator
- Compatible with both GPS signal formats
- Downlink frequency selectable via inductive setting process
- Standard NATO Form Factor





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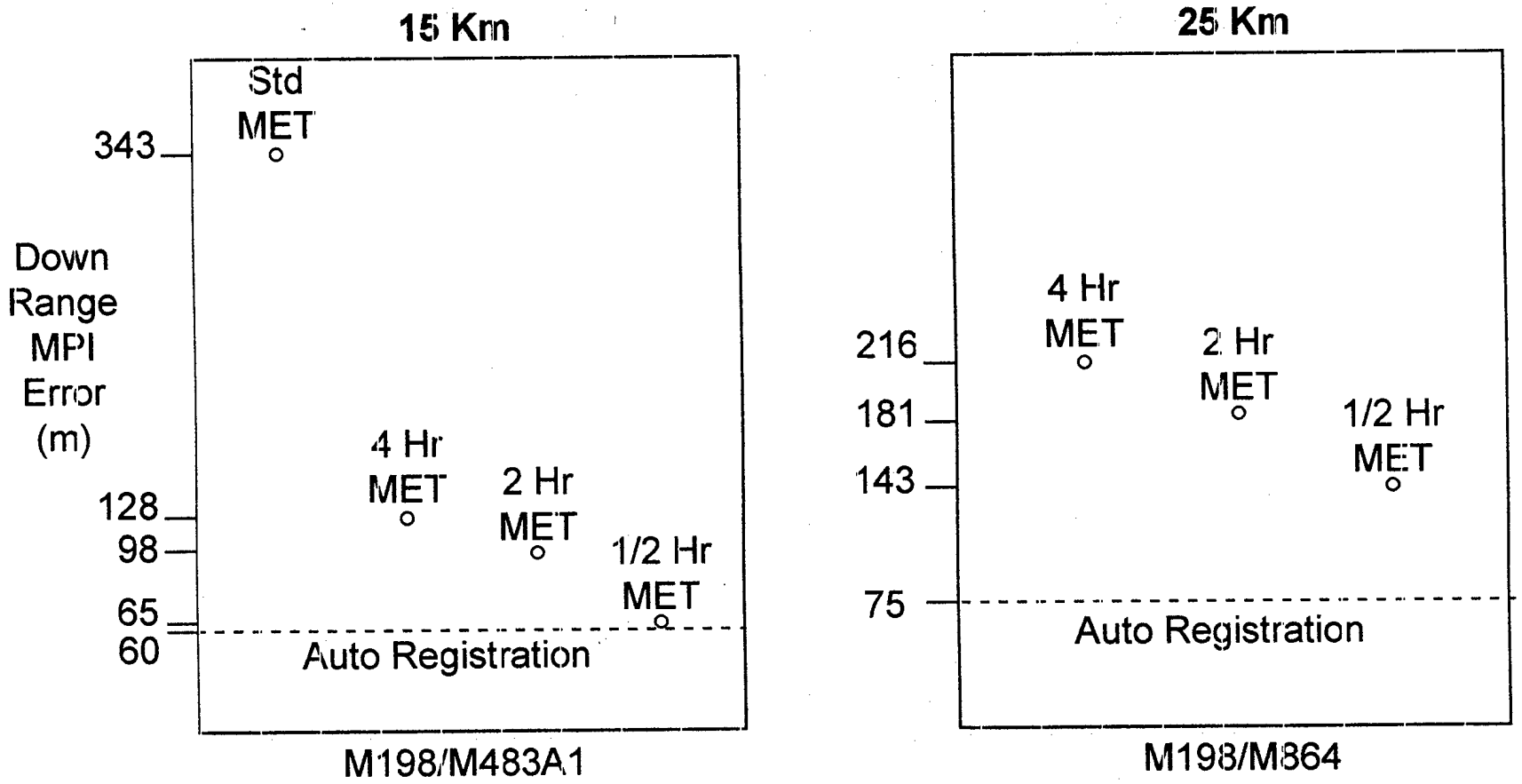
Projected Accuracy Improvements



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Impact of Effectiveness

Scenario	Range	Number of Rounds Required (F_C = 0.3)	
		Predicted Fire Without Auto-Registration	With Auto-Registration Corrections
• M198 Howitzer • Standard MET • M483A1 Projectile	15 Km	115	15
• M198 Howitzer • 2 Hour MET • M549A1 Projectile	25 Km	78	27

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Program Summary

Current Contract

- Alliant Techsystems developing system to demonstrate real time system function
- Cooperative development with ARDEC and ARL
- Demonstration in October, 1998

What Next

- Fuze module design merging fuzing and auto-registration functions
- Explore expanded uses of trajectory data in the Digital Battlefield

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Payoff

- Increased effectiveness of current inventory projectiles at low cost
- Reduced logistics burden
- Increases survivability

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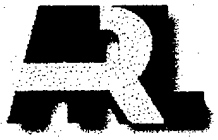
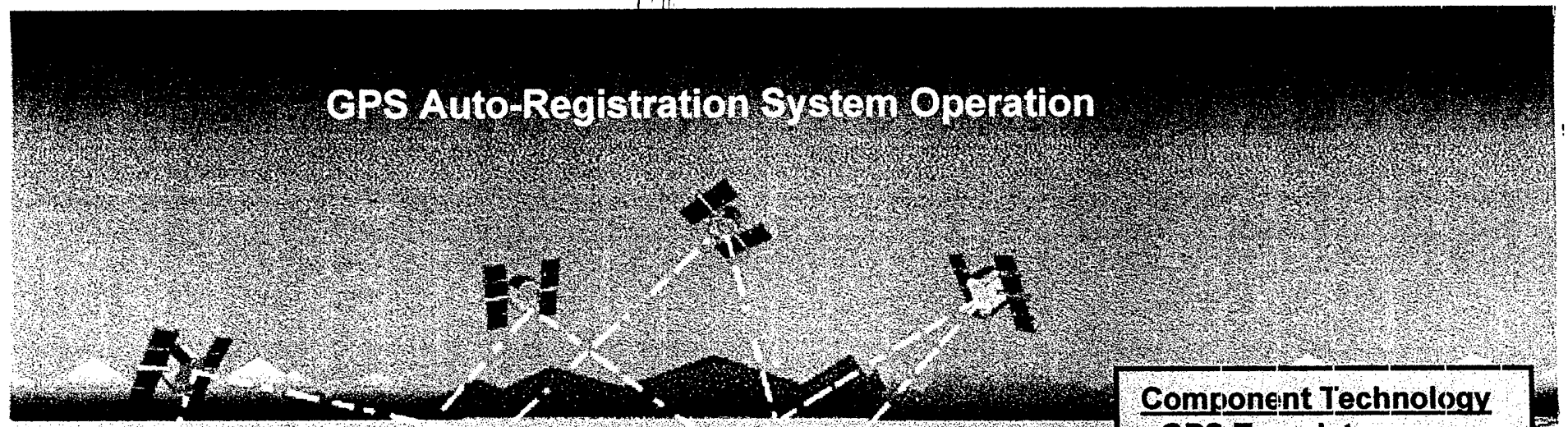


GPS Auto-Registration System Operation



Component Technology
- GPS Translator
- Ground Based Receiver

Provides Automated, Unobserved Accurate Registration

- Onboard GPS Translator Relays Signals to Ground Receiver
- Actual Trajectory is Calculated
- Impact Point is Predicted & Compared to Aimpoint
- Ballistic Computer Generates Corrections for Immediate Transfer to Subsequent Fire